

# *BIODYNAMIC DWELLING*

*picking up the trailer trash*



*BIODYNAMIC DWELLING* is a graduate design thesis which explores the current status of the “mobile home,” its ubiquity, and its history, ultimately seeking to innovate this commodified housing type. Millions of Americans reside in “mobile” residences of varying types, harbored in an environment which is neither healthy nor appropriate in a post-fossil fuel era where energy independence is paramount.

As the most humane and personal of all built spaces, the dwelling affords the unique position to at once provoke, question, and inform the position of architecture within the realm of society. This proposal for a biodynamic dwelling—at once both *bioclimatic* and *dynamic*—suggests a living arrangement which rejects the current proliferation of stasis and homogeneity in housing, while embracing an adaptive, flexible alternative. The intention is that the dwelling, passive in existence and dynamic in nature, will support a deeper engagement with one’s living space, while also providing a greater cognizance of natural cycles.

## *BIODYNAMIC DWELLING*

by Amber Ellett

A terminal project presented to the faculty of the College of Architecture at the University of Nebraska in partial fulfillment of requirements for the degree of Master of Architecture

Major: Architecture

Under the supervision of Professor Martin Despang

Lincoln, Nebraska

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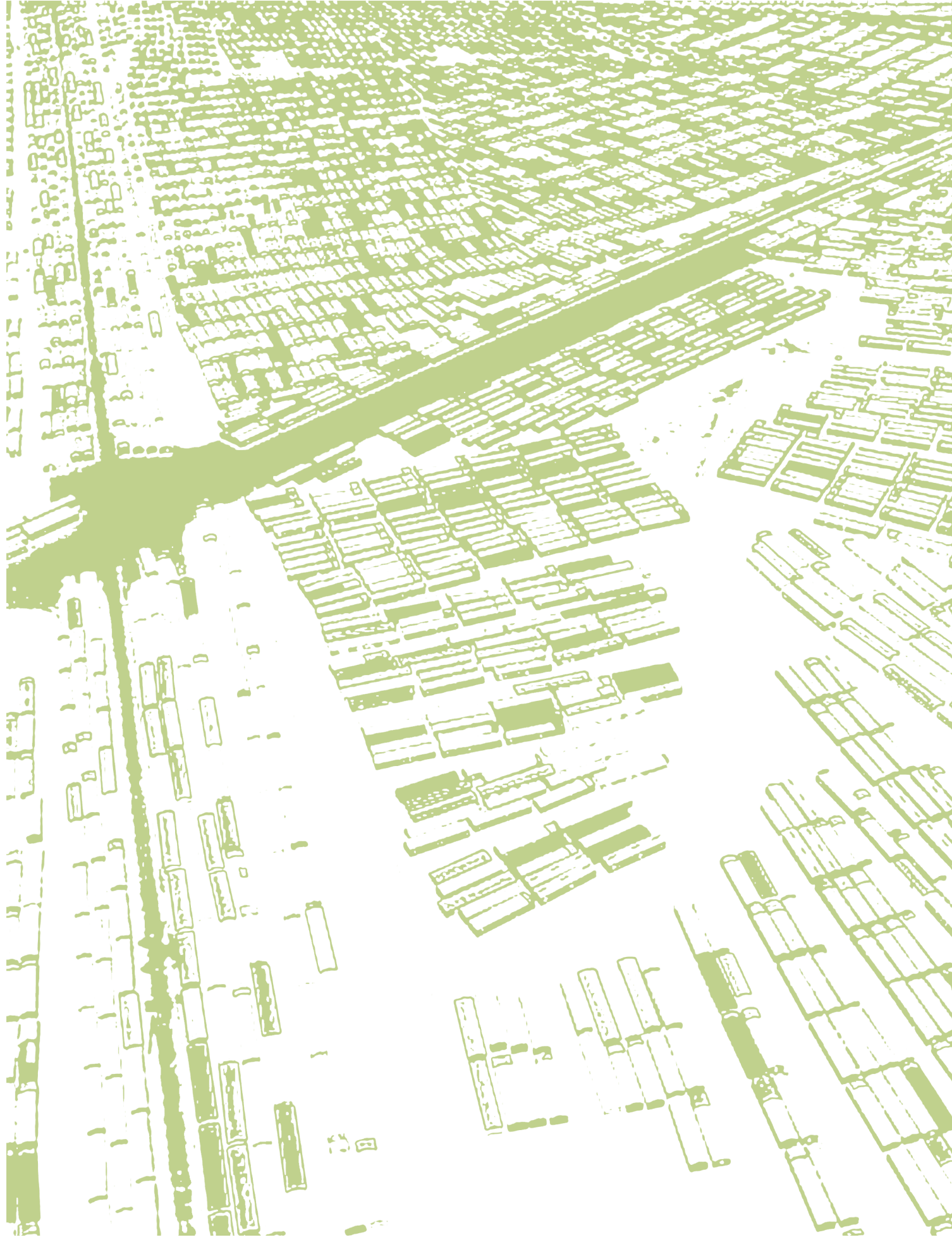
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## ACKNOWLEDGEMENTS







A discontinuity in mobility



As the implications of man's dominion over nature become increasingly evident, a fundamental examination of the role of the built environment, as both a cause and an effect of such changes, seems eminent. This proposal examines the most necessitated of built spaces: the dwelling. While the premise of this study is intrinsically rooted in the exploration of architectural mobility, the comprehensive focus of the proposal constitutes a critical assessment of the homogeneous and fundamentally unsustainable living conditions currently proliferating in the United States.

The current example of a dwelling, static and unchanging, contradicts the vernacular instances taught by this country's indigenous peoples. Nomadic societies have been existent since the cultural beginnings of man. Through necessity, all that was essential to survival possessed the ability to be transported to another location at any time—the most elemental of these provisions being shelter. This phenomenon persists as a continual, non-regressing trend in society today, encompassing all cultural and socioeconomic stratospheres.

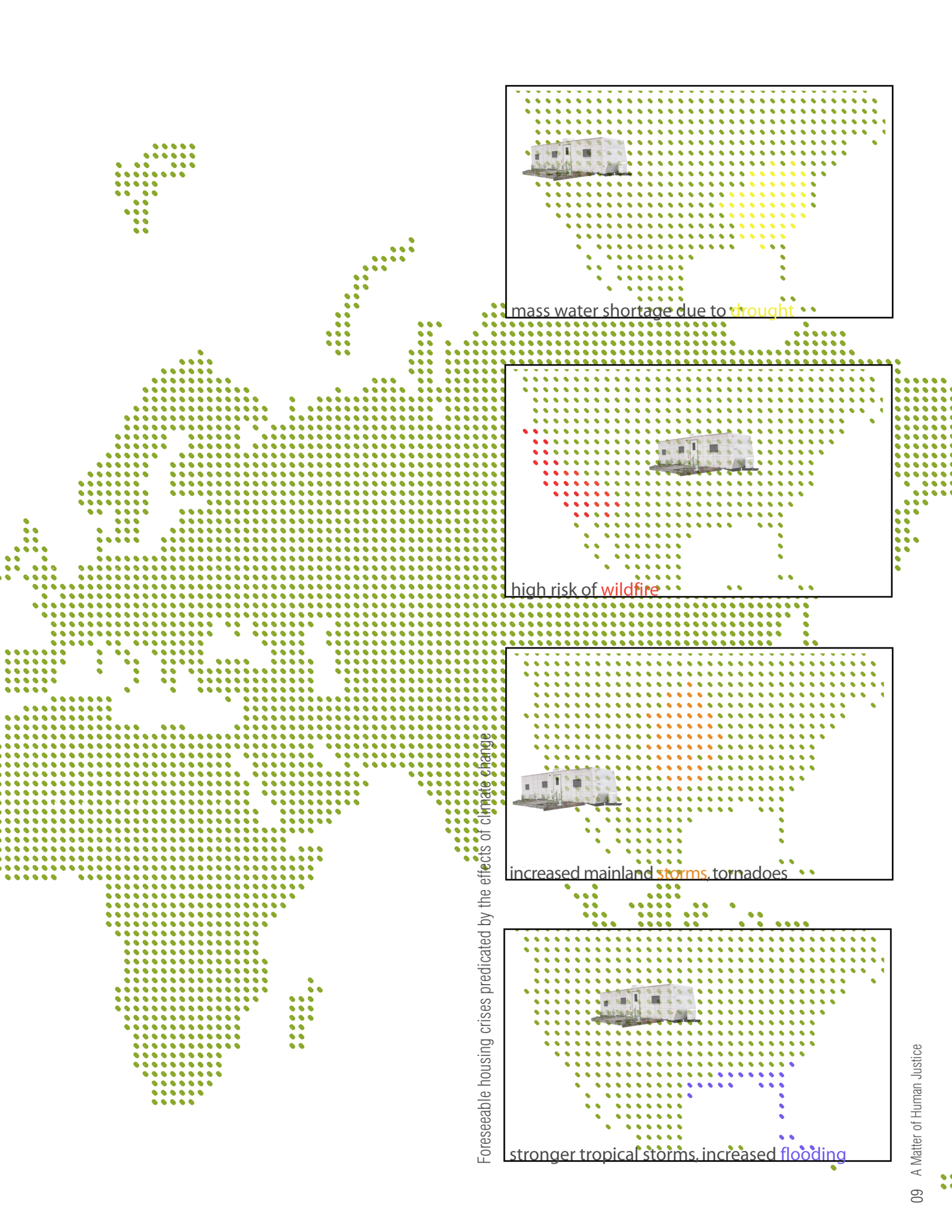
From luxury RVs to utilitarian trailers, the typology of the mobile dwelling exists in many sizes and forms. As a dwelling type utilized by millions of people, the "mobile home," as it currently exists proves substandard on a number of levels. On a broader scope, the typology of the non-static dwelling has largely not been addressed as it pertains to the low-income residents which most often occupy it.

The current oil crisis and subsequent "green" building trend illustrates another challenge in addressing mobile architecture. This proposal aims to address dwelling in a post-fossil fuel society, while also exploring the potential of diversity through simplicity and efficiency through minimization, in order to cause less impact on the natural environment, while all the while enriching the inhabitable space of residents.

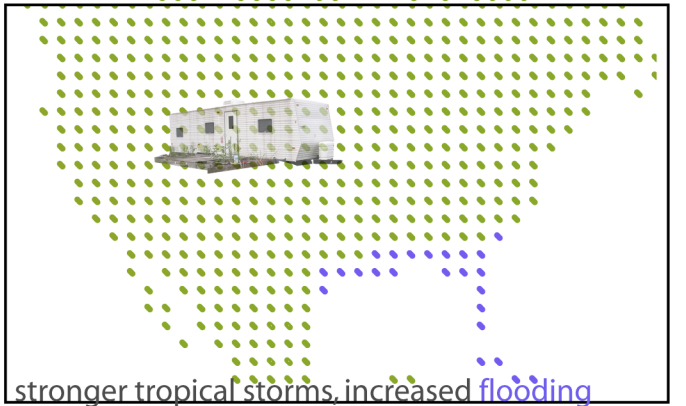
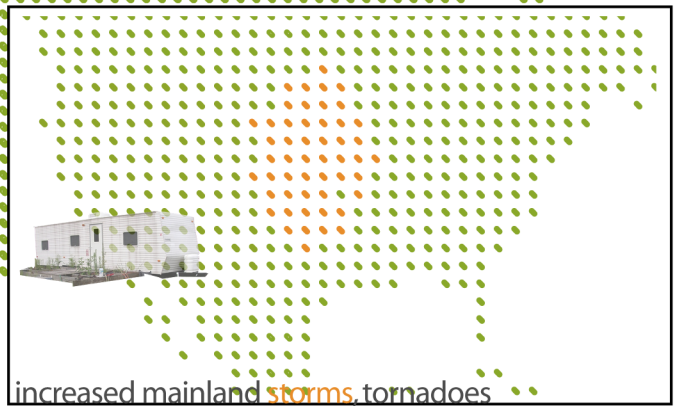
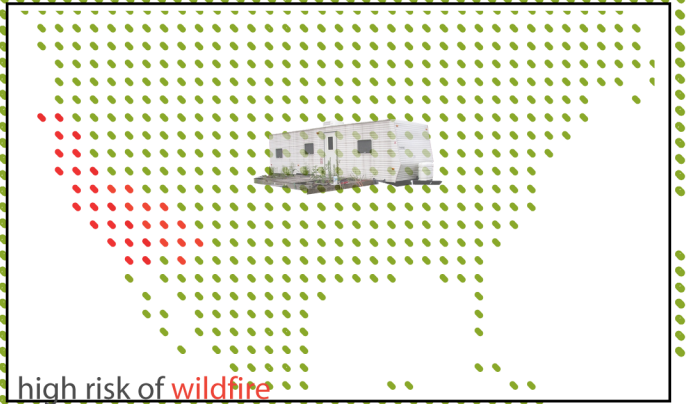
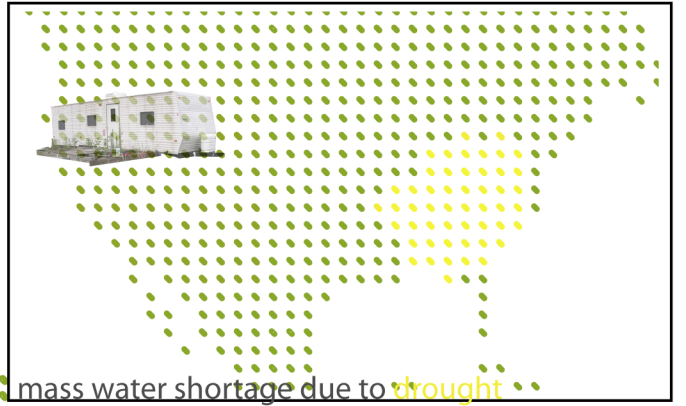




It has been estimated that 200 million people will be displaced worldwide due to the effects of climate change by mid-century. While mobile architectural objects [from travel trailers to recreational vehicles] were first conceived as leisure / luxury items, an evident shift could be forecasted from mobility for the sake of preference, to a new mobility for the sake of convenience or even necessity. As natural phenomena intensify, the effects of these events [increased floods, more intense droughts, stronger storms, etc.] may require that the widely-accepted model for dwelling be called into question. Further, the unpredictable availability of energy and subsequent unstable future economy offer another case for a high-performance, adaptive, transportable architecture.

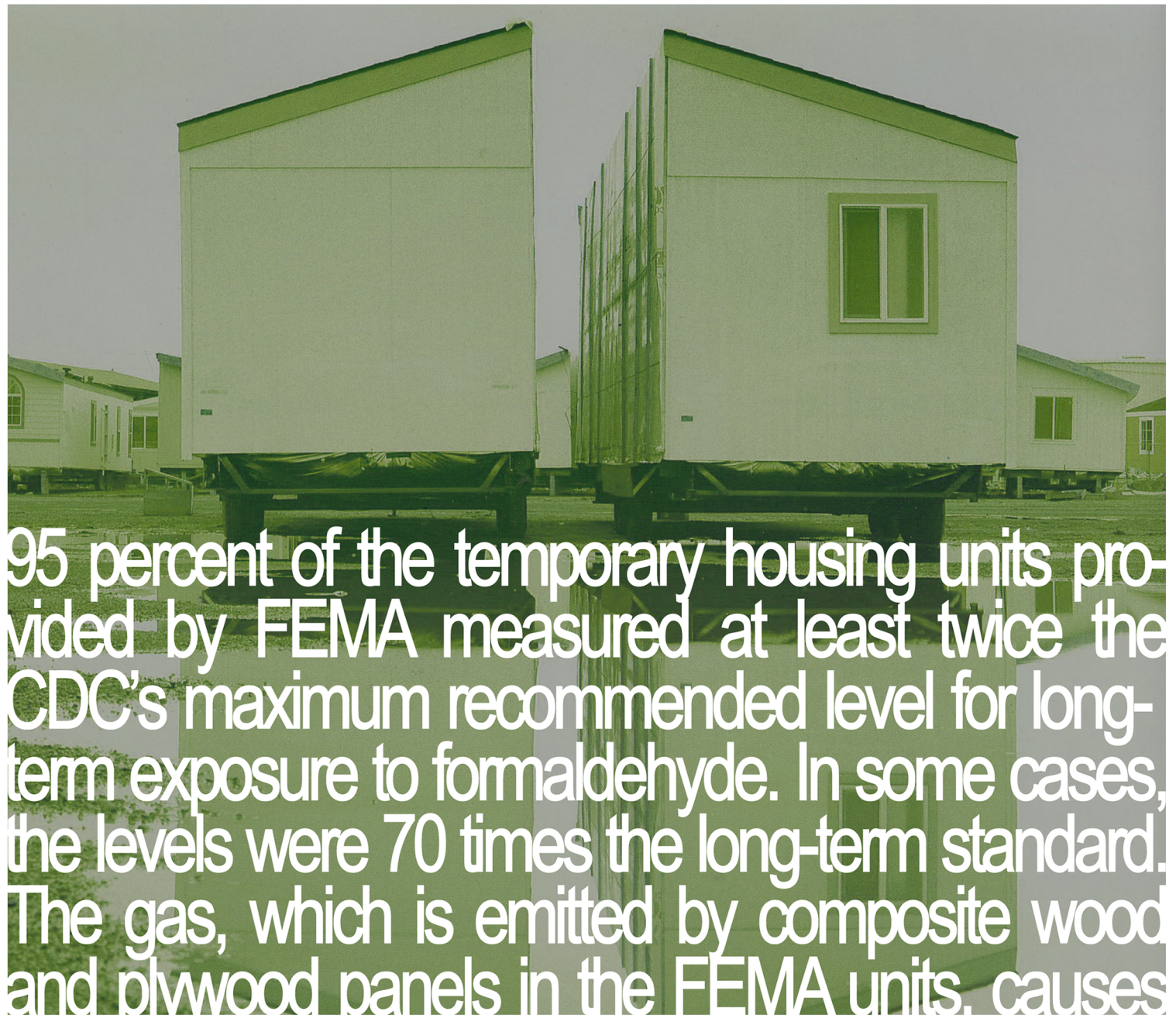


Foreseeable housing crises predicated by the effects of climate change









95 percent of the temporary housing units provided by FEMA measured at least twice the CDC's maximum recommended level for long-term exposure to formaldehyde. In some cases, the levels were 70 times the long-term standard. The gas, which is emitted by composite wood and plywood panels in the FEMA units, causes









95% of mobile dwellings, once positioned on a site, are never moved again.

## Need Help Paying Electric Bills?

June 12, 2007

### HOUSING

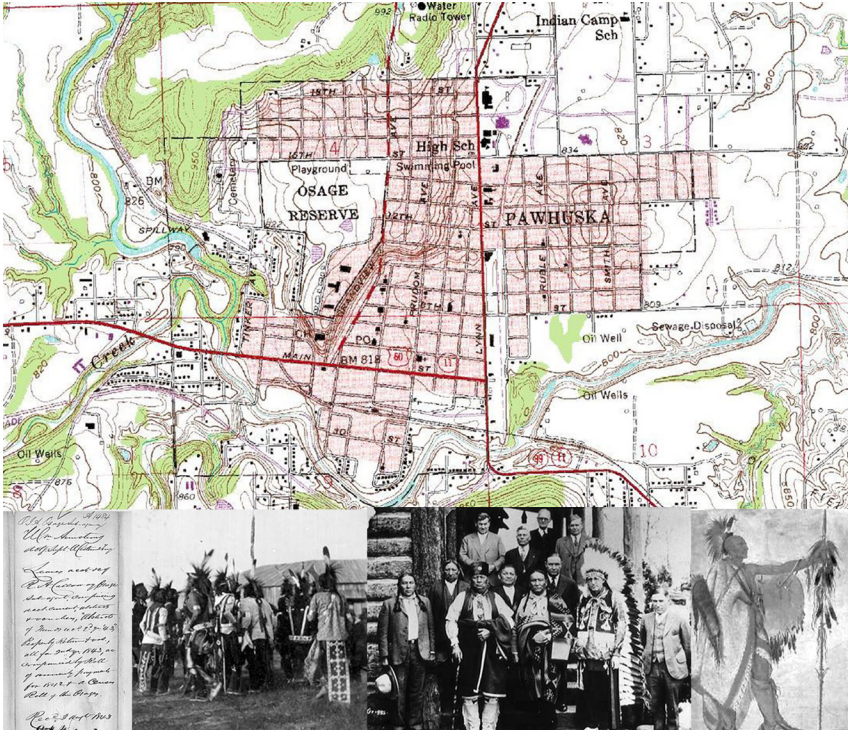
### HIGH ELECTRIC BILLS? NEED

If you:

- are a resident of Osage County / Osage Reservation
- & possess a C.D.I.B. or Membership card
- qualify by 125% Poverty Income Guidelines (contact Housing Dept. for more info.
- or recipient of T.A.N.F., SSI, or Food Stamps

you may qualify to receive Osage Nation LIHEAP assistance. Please contact

**PAWHUSKA — A5 Osage**  
**OSAGE HILLS** (State Pk) E-bnd: From S Jct o US-60 & Hwy 99, N 6 mi on Hwy 99 to US-60, E 8 m to park access rd. S 2 mi (L); or W-bnd: From Jct o US-75 & US-60, W 16 mi on US-60 to park access rd S 2 mi (L). ZIP 74056. Good paved interior rds. 1 rental units. **SITES** 55 paved, mostly shaded, 2 pull thru sites (30x50), 14 day max stay. **FAC** Restrooms & showers, dump, public phone. **REC** Lake Lookout: freshwater fishing, boat rental, pool playground, rec field. Last year's rates: \$8 to \$15. V MC, D, osagehills@oklahomaparks.com (918)336 4141  
**SETTLE INN RV PARK** (Priv) From Jct o US-60/SR-11 (east of town) & SR-99, S 2.4 mi or SR-99 to CR-2520, E 0.1 mi (E). ZIP 74056. Goot gravel, patios mostly shaded. 12 pull-thrus (36x65), big rig sites 12 full hookups (30/50 amps). **FAC** Restrooms & showers. Last year's rates: \$19. V, MC, razncain@cox.net (918)287-3445 #TL: 2876



The Osage Indian Reservation serves as one case study of the great need for improved low-income living conditions and greater energy independence. The site, located in northeast Oklahoma, in close proximity to the Skiatook Lake area is largely wooded and undeveloped. This area in Osage County, Oklahoma, is largely comprised of descendents of the Osage Indian Nation, and presents an interesting instance for exploration, as the vast majority of Indians both on an off the reservation reside in trailer homes. Recreational vehicles and makeshift transient homes are also not without representation in this area. The specified site is distinct in that it would allow the implementation of a new type of dwelling where current forms of traditionally nomadic societies currently reside. Though only one example, a plethora of opportunities exist to apply the biodynamic dwelling to different cultural instances and social realms.













Exterior, typical



- formal disregard for solar orientation
- low-grade materials predicate poor envelope performance
- few windows prohibit natural ventilation
- immediate area dominated by vehicular necessity

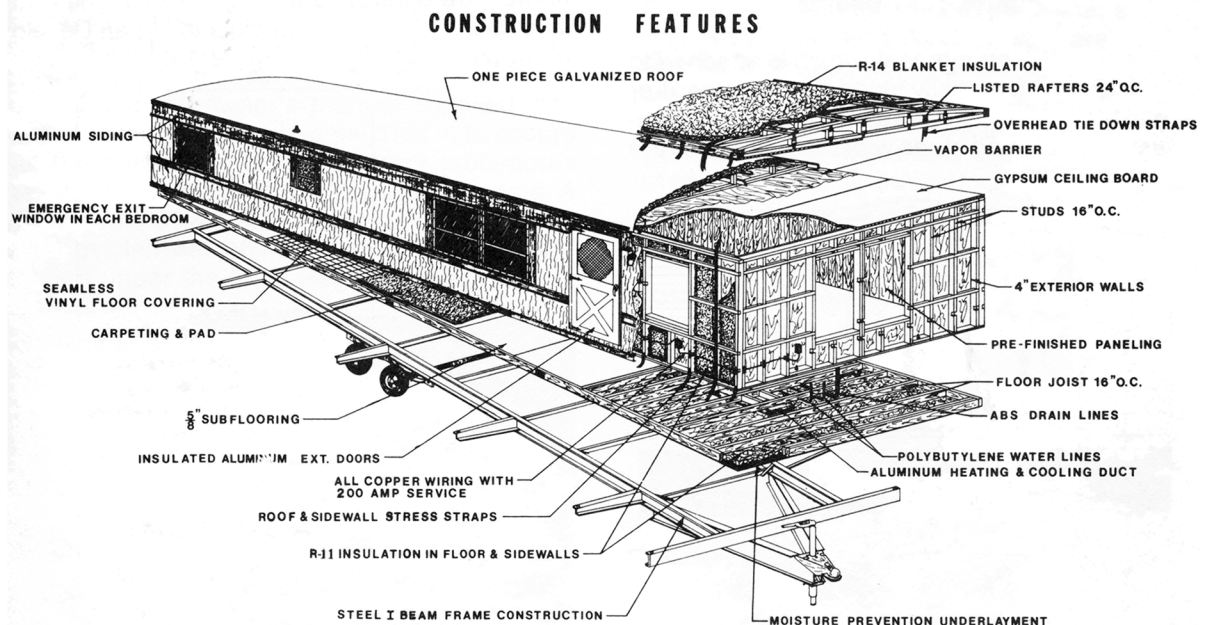
Interior, typical



- poor natural daylight, requiring energy dependence
- cramped interior with low, isolating ceilings
- static program spaces, with no opportunity for flexibility



The interior is flexible, with various furniture elements stored in the cavity space of the walls and floor. Utilities connect to existing infrastructure via a structural base, which also contains the rotating mechanism. The interior is flexible, with various furniture elements stored in the cavity space of the walls and floor. Utilities connect to existing infrastructure via a structural base, which also contains the rotating mechanism. The interior is flexible, with various furniture elements stored in the cavity space of the walls and floor. Utilities connect to existing infrastructure via a structural base, which also contains the rotating mechanism. The interior is flexible, with various furniture elements stored in the cavity space of the walls and floor. Utilities connect to existing infrastructure via a structural base, which also contains the rotating mechanism.

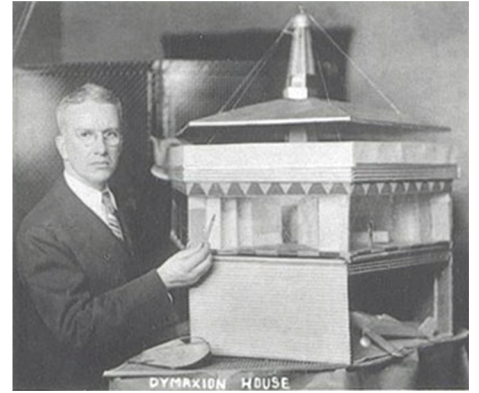






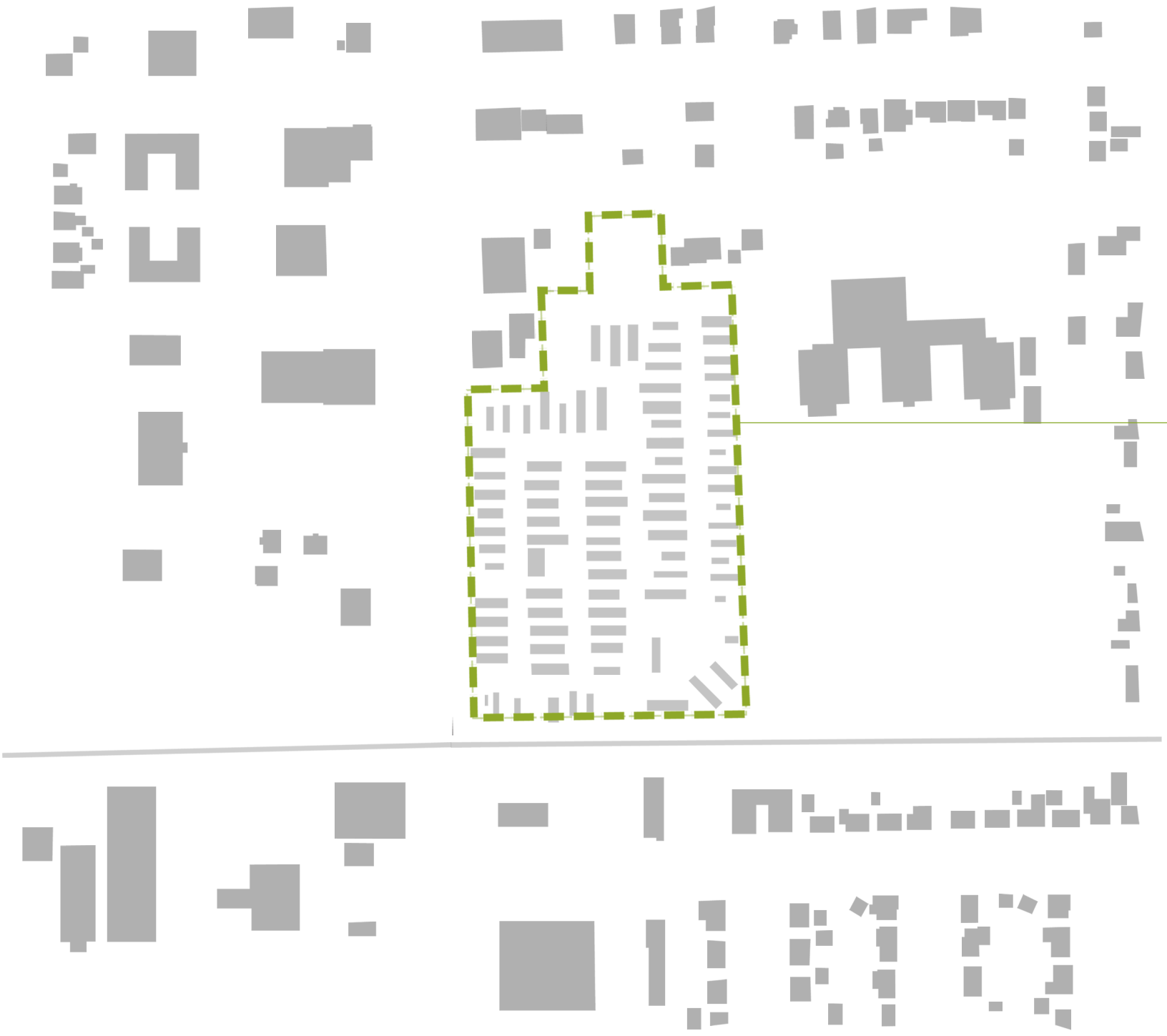


Though transportable architectural environments came into existence in the 1920s and 1930s to fulfill a desire for a leisurely mobility, and to cater to a cultural phenomenon, their purpose and execution have varied greatly throughout their short history. As housing shortages proliferated during the time of the Depression, and became even more pressing after World War II, trailers and caravans, once meant for short-term pleasure travel, became permanent dwellings. This shift from short-term to permanent mobile “home” constituted the negative stigma associated with the mobile dwelling, and the subsequent classification of its residents as “trailer trash.”



“This is the real news of our century. It is highly feasible to take care of all of humanity at a higher standard of living than anybody has ever experienced or dreamt of. To do so without having anybody profit at the expense of another, so that everybody can enjoy the whole earth.”

-Buckminster Fuller, lecture 1929





Sky View Mobile Home Ranch  
1030 N 48th Street, Lincoln, Nebraska  
current occupancy: 86 residences





Sky View Mobile Home Ranch, Lincoln, NE

convenience store

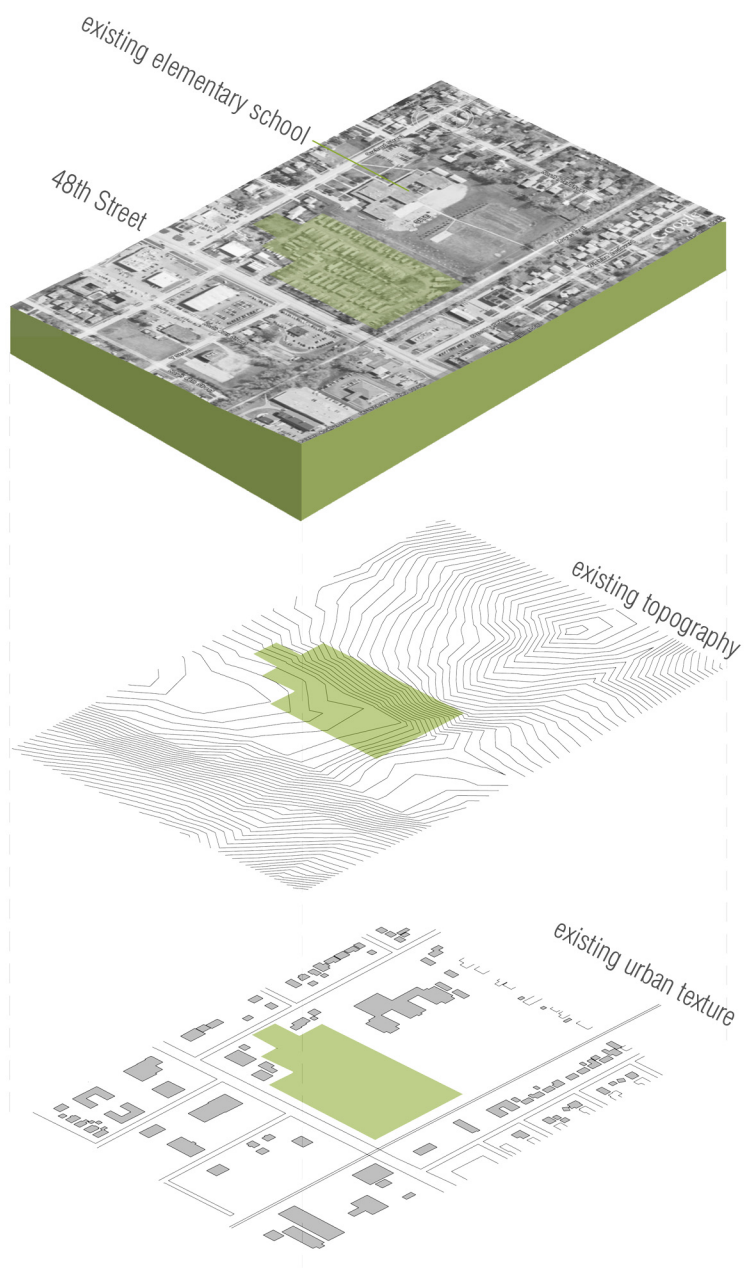
residence of park manager

improvised storage space between units

park business office

communal laundry building

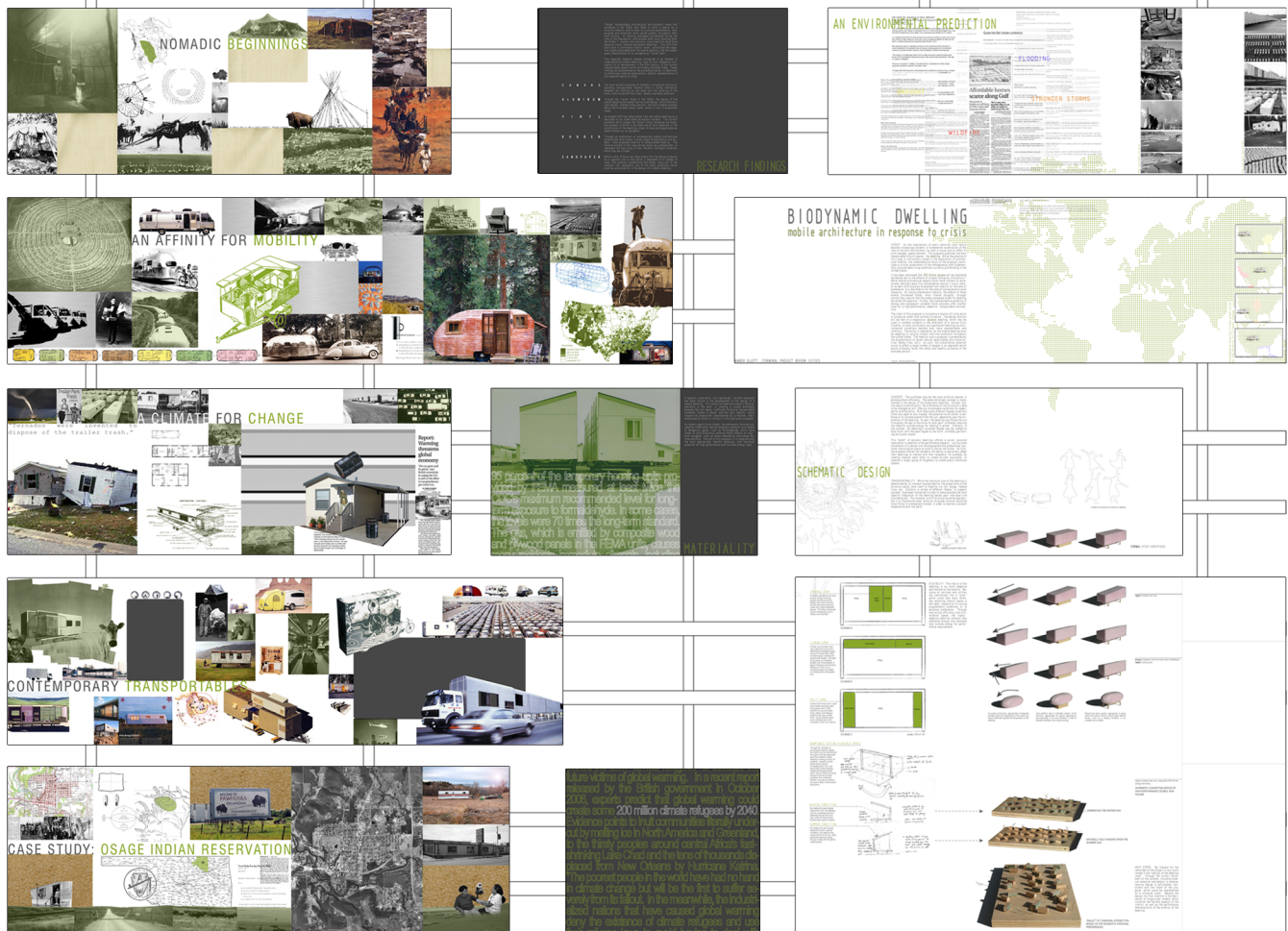












Five separate research phases transpired in an attempt to understand the mobile dwelling, from its first indigenous conception to its development in the 20th century, to the current transportable objects which are widely available today. These findings are documented on the above display boards, each with an additional preliminary material exploration, directly representative of the specific topic of study:

**CANVAS** The most ancient examples of nomadic civilizations and corresponding transportable shelters show a strong connection between the clothing for the body and the covering of the home, both extracted from local, readily available materials.

**ALUMINUM** Through the “trailer” boom in the 1930s, the design of the mobile dwelling borrowed from aircraft design, which affords a light-weight, unibody frame and skin, the most notable example being the Airstream travel trailer, which is still in production today.

**VINYL** An evident shift has taken place from the mobile dwelling as a desirable to an undesirable permanent resident. The current problems which plague the typical trailer residence are many, the greatest of which is the wide use of toxic materials in the construction of the dwelling, shown to have prolonged adverse health effects on its residents.

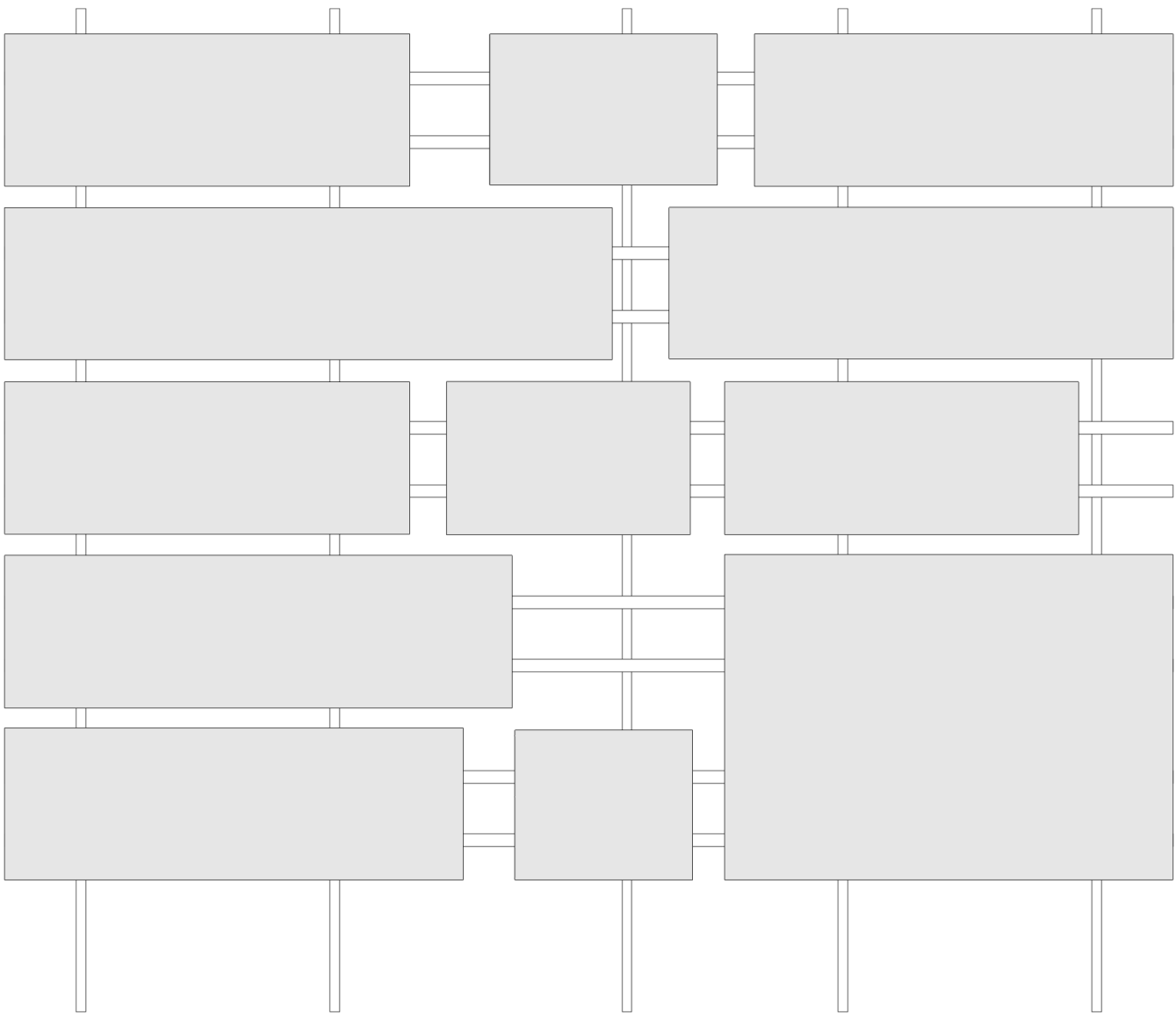
**RUBBER** Through an exploration of contemporary mobile architectural propositions and studies, a wide range of implications are evident: from purposed mobility to necessitated mobility. The material artifact in this case serves mostly as a placeholder, to represent the vast array of new, flexible, intelligent materials which may be utilized.

**SANDPAPER** While a shift of focus has taken place from the design proposal for a specific site to one which is adaptable to a number of sites, this material (symbolizing the sandy, rocky soil of the southern US) represents one of the many conditions which must be accounted for in the design of a mobile dwelling.

A specific exploration into lightweight, flexible materials has been crucial in the development of a biodynamic dwelling. This notion has been portrayed in the physical presentation of the work, in creating a visible dichotomy between the very heavy, inefficient historical transportable examples, as shown through research [in wood], and the light, healthy, highly responsive proposition [represented by a flexible, channeled plastic in this instance] which is intrinsic in this particular proposal.

As recent reports have shown, the emergency housing provided by FEMA after natural disasters contains toxic levels of dangerous gases, such as formaldehyde, which have shown to have disastrous adverse health effects on long-term residents, such as those affected by Hurricanes Katrina and Rita. As this example shows, the integration of only the most appropriate materials is crucial, not only to ensure they are healthy, but also to explore the potential for high performance with minimal energy input.

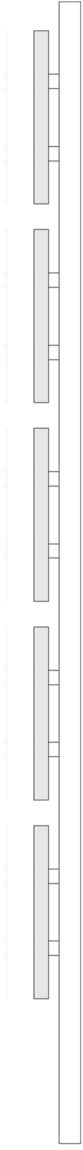




Front Elevation



Plan



Side Elevation

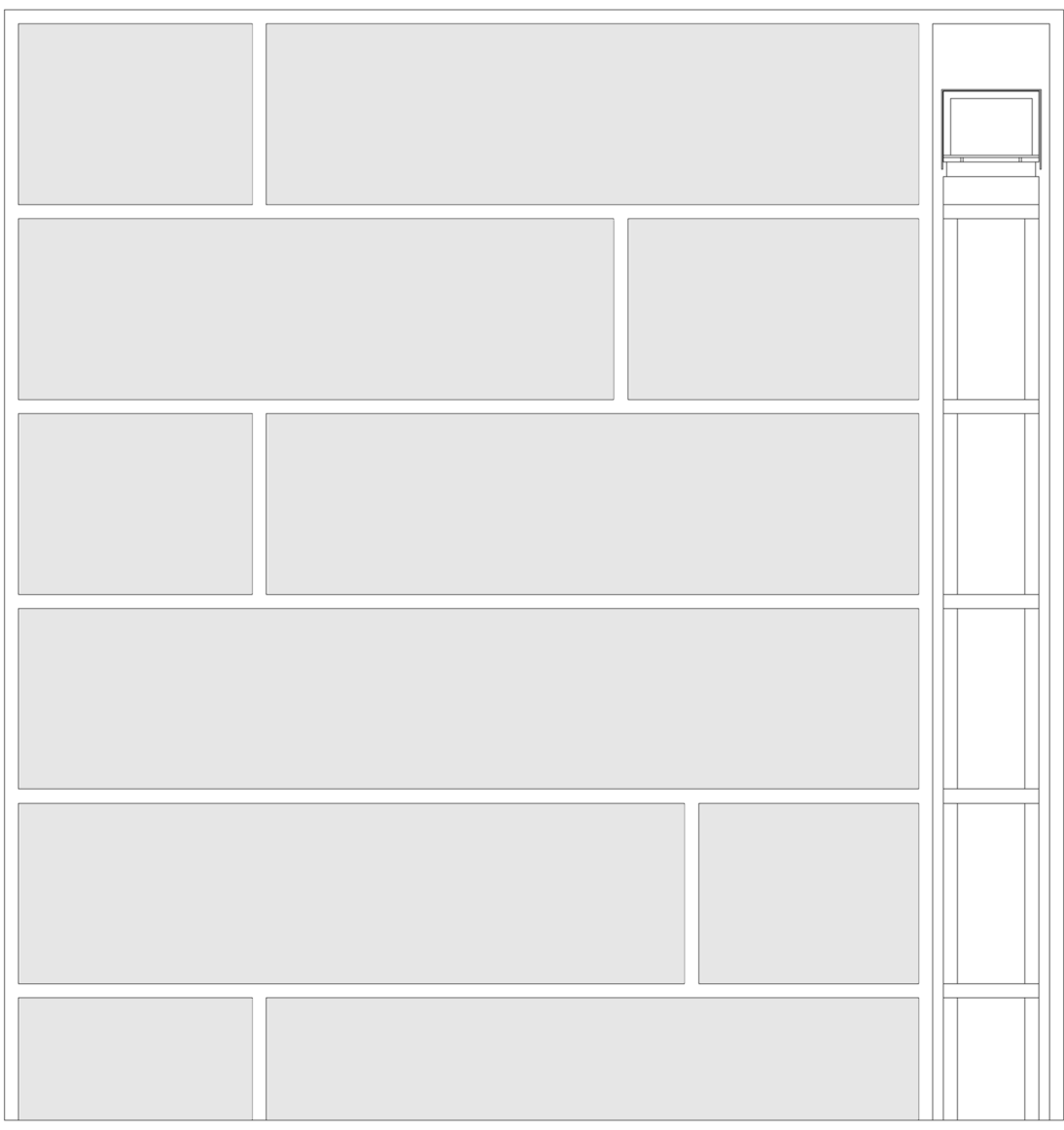






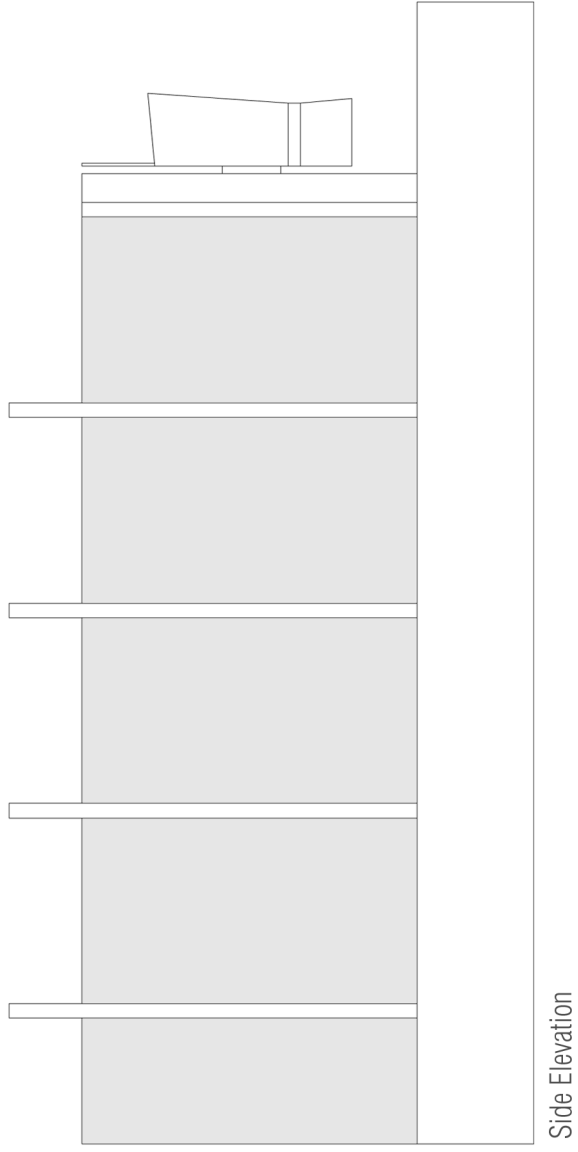


Plan



Front Elevation











The sunflower may be the most primitive teacher in photosynthetic efficiency. The same heliotropic concept is implemented in the design of the biodynamic dwelling: through rotation about a central point, the orientation of the structure is able to be changed at will, offering innumerable conditions for adaptability and flexibility. With drastically different façade conditions [from very open to very closed], the potential exists either to embrace or to insulate oneself from the sun, depending upon the orientation of the dwelling. As well, the dwelling may follow the sun throughout the day to maximize its solar gain, ultimately reducing the need for outside energy for heating in winter. Similarly, in the summer, the dwelling's insulated façade may be rotated to face south, with the open façade to the north, ultimately performing as a solar shield.

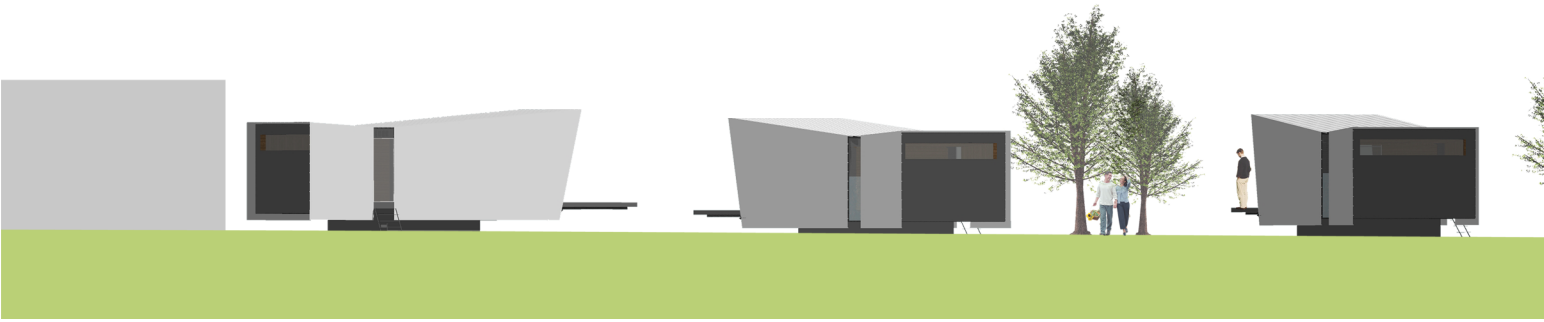




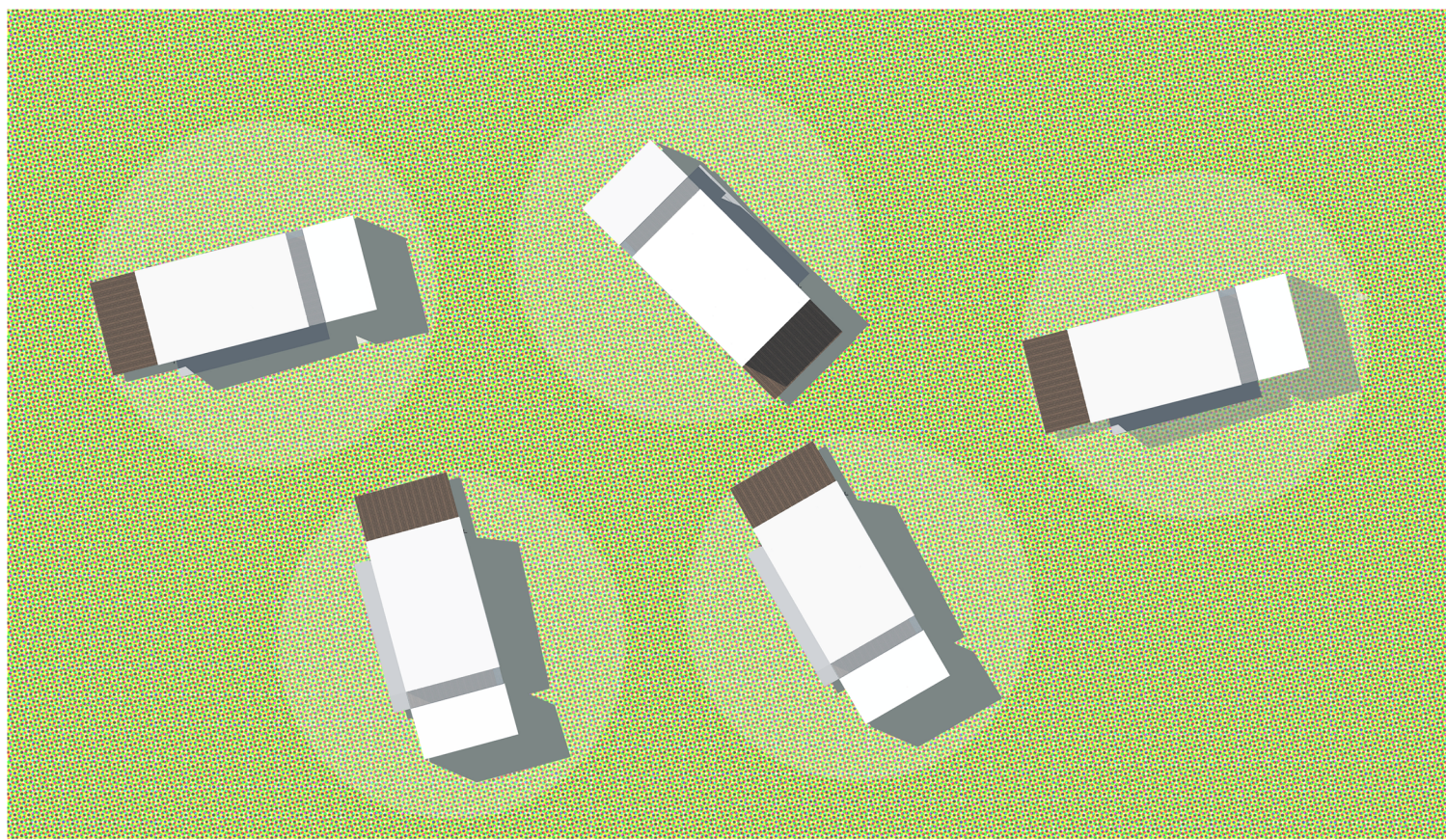
Existing static arrangement



This “ballet” of dynamic dwellings affords a social, personal implication in addition to the performance aspects. Just as some movements of a dancer are choreographed and predestined, personal improvisation plays as much a role as the former. As such, the proposal affords the residents the ability to personally adapt their dwellings to interact with their neighbors, for example, by rotating towards each other to create private courtyards, or towards a larger group of neighbors to create public communal spaces.



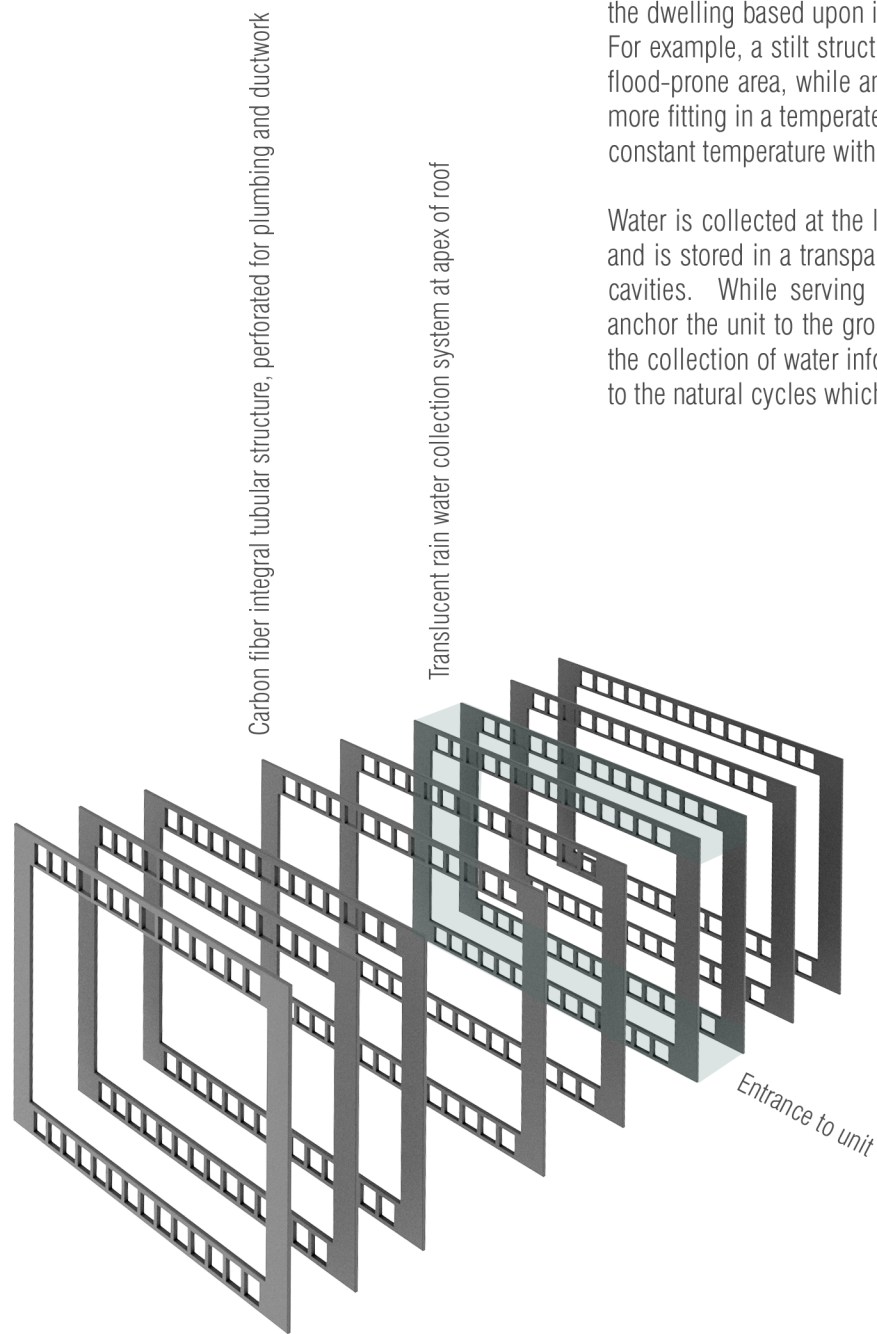




Proposed biodynamic arrangement



Park elevation, variable



Carbon-fiber, with its incredible flexural strength and minimal weight, proves the most appropriate structural system. An integral tubular structure, similar to that in automotive manufacture, is wrapped in a carbon fiber mesh, to provide great rigidity, as well as flexibility.

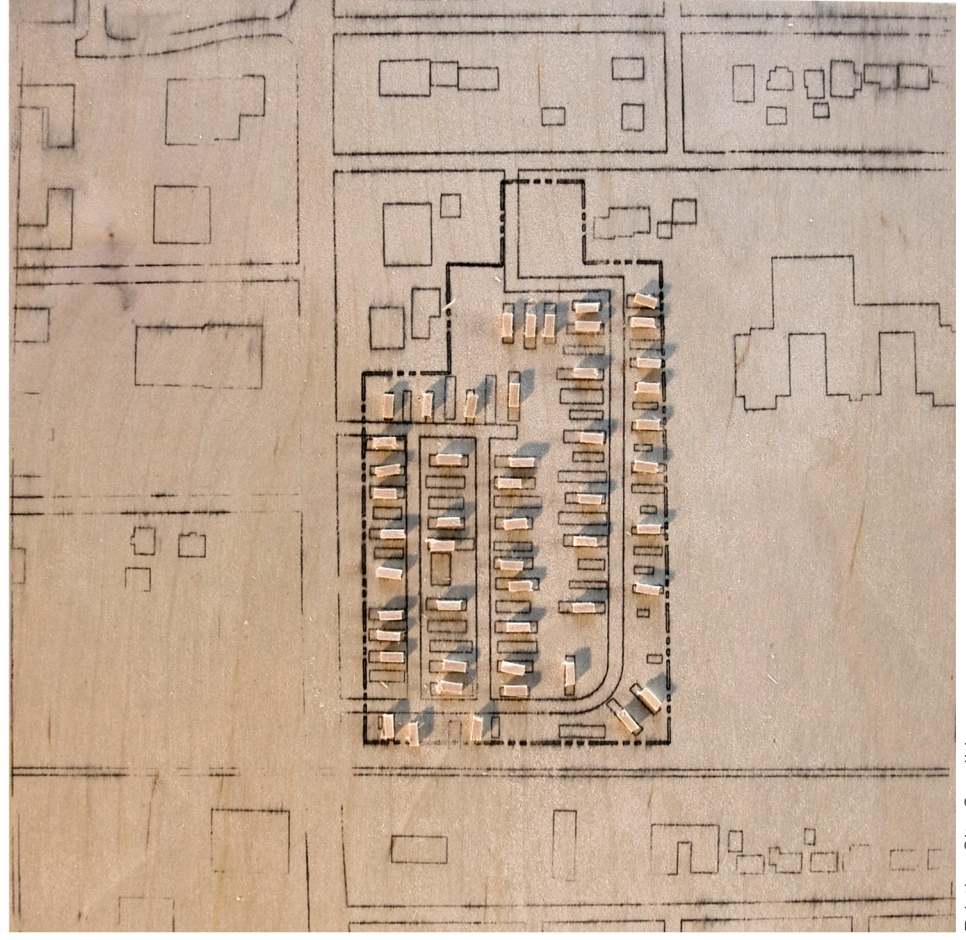
While the maximum size of the dwelling is determined by its inherent transportability, the proportions of the structure easily lend itself to mobility via rail, barge, flatbed truck, etc. Similarly, a variety of different “bases,” or support systems, have been conceived in order to make possible the most specific integration of the dwelling based upon individual site considerations. For example, a stilt structure would be appropriate in a flood-prone area, while an on-grade solution would be more fitting in a temperate climate, in order to maintain constant temperature with the earth.

Water is collected at the low point in the butterfly roof, and is stored in a transparent tank in the floor and wall cavities. While serving also as additional weight to anchor the unit to the ground, the visual cognizance of the collection of water informs a greater consciousness to the natural cycles which provide this resource.





Proposed Dynamic Communal Variations

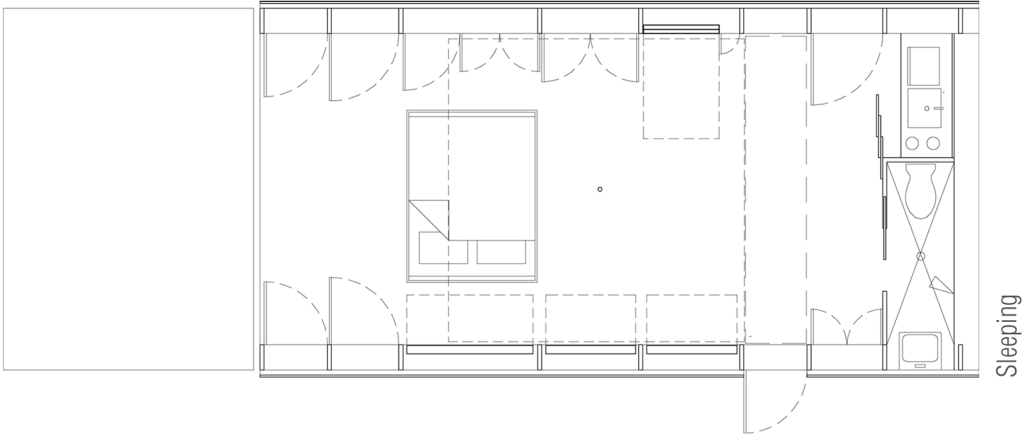
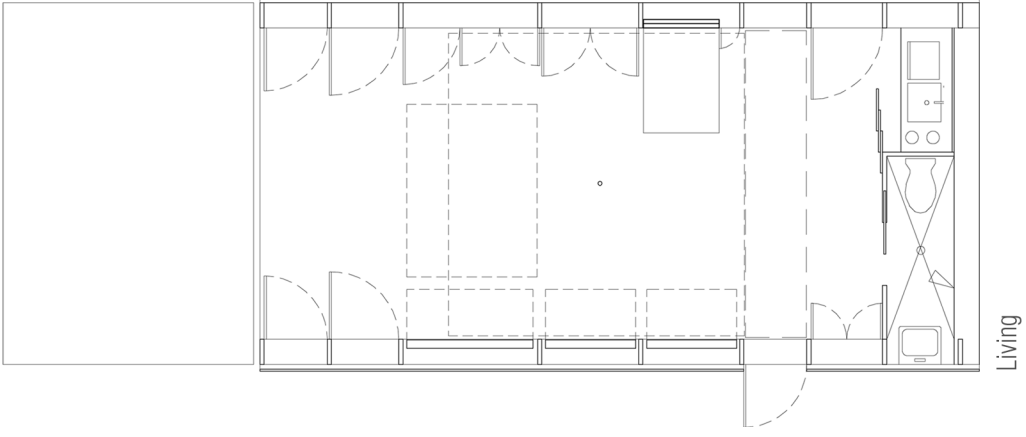
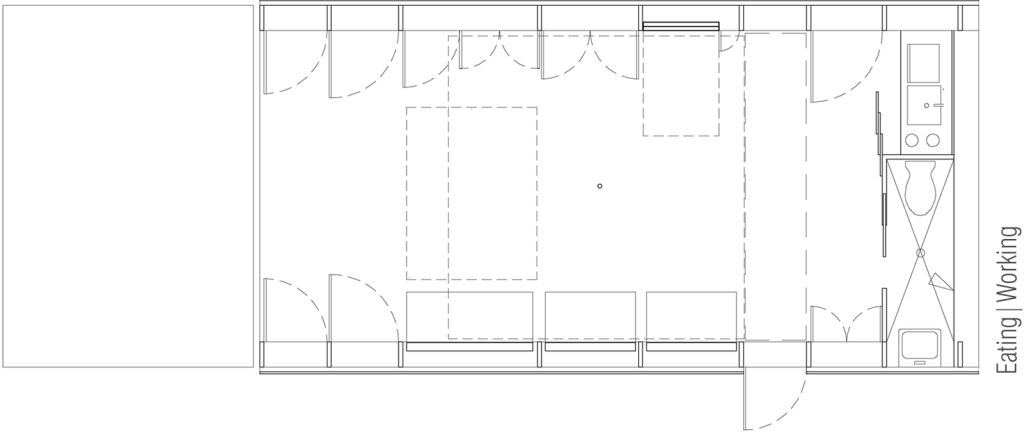


Existing Site Condition



43 A Bioclimatic Way of Life





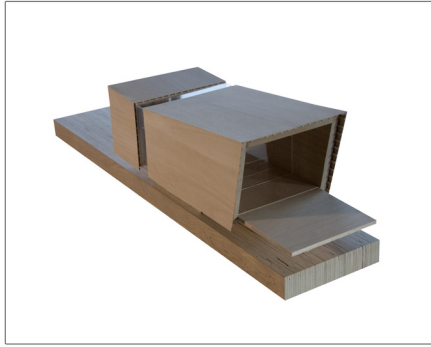
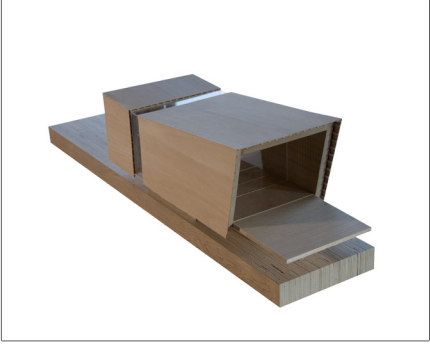
The interior of the dwelling is as much adaptive and flexible as the exterior. Because all services and utilities are centralized into a core, the remaining interior space is left open, responsive to varying programmatic conditions or to personal preference. The wall and floor cavities are thus used as a spatial proposition, serving to store various furniture pieces, which may be opened or folded out at will. Through maximizing efficiency and minimization space, the highly-adaptive dwelling contains less embodied energy and demands less outside energy for performance requirements. A geothermal heat pump system serves much as the roots of a tree, to physically anchor the unit to the ground.



Section [in motion]











The resultant biodynamic dwelling which, using the same technology as a swing bridge, may be rotated manually by the user, allows the resident to react to bioclimatic considerations or social impulses. In this way, a new type of freedom is afforded this prosaic building type, and an entirely new spatial and psychological awareness is created. In a rejection of the current trend of excessive consumption and unconscionable waste, this proposal proves the philosophy of maximization through efficiency and diversity through simplicity, and in that way manifests a responsible humanitarian position through built form.





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